SPIXIANA	4	3	247–254	München, 1. November 1981	ISSN 0341-8391

A Preliminary Study of Bark Damage by Cervids in the Ruhuna National Park, Sri Lanka

(Mammalia, Cervidae)

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Abstract

Large numbers of cervids, mostly spotted deer *(Axis axis)* live in Block I of the Ruhuna National Park, Sri Lanka. In this preliminary study, cervids were found to damage 28 species of trees and shrubs by bark stripping and antler rubbing. Most damage was done to trunks of average girth of about 11 cm and at a height of about 83 cm. Bark stripping perhaps occurs mainly during the drought season and serves to provide the cervids with additional sources of nutrients and/or water. Bark stripping and antler rubbing may be partially responsible for preventing the thorny scrub of the Park from reverting to climax forest.

Introduction

The family Cervidae in Sri Lanka is represented by four species, namely the barking deer or muntjac *(Muntiacus muntjak)*, the spotted deer *(Axis axis)*, the hog deer *(Axis porcinus)* and the sambar *(Cervus unicolor)*. All are found in the Ruhuna National Park, Sri Lanka, with the exception of the hog deer. According to Eisenberg & McKay (1970), the hog deer is believed to have been introduced to Sri Lanka from South India by the Dutch. It is now restricted to the rain forests in the south-western region of the island.

Of the three species of cervids found in the Park, the spotted deer is the most abundant and truly social, occurring in herds of more than 100 animals. The sambar is less abundant and may be found in smaller herds (less than 30 animals) in open places, though it spends most of its time in the scrub forest. The muntjac is the least abundant cervid and it is generally solitary. The antlers of the muntjac are supported on long pedicles and consist of

very short brow-tines and undivided beams (Phillips 1935). The antlers of spotted deer and sambar stags however have short pedicles and are three-pronged. The short, simple one or two-point antlers of muntjacs represent the primitive condition from which the long, complex, three-point antlers of spotted deer and sambar could have evolved (Geist 1971, Kurt 1978). While both muntjac and sambar are predominantly inhabitants of dense scrub in close proximity to permanent water, the spotted deer is typical of more open scrub and grasslands. However, all three species spend a large part of their diel cycle inside the scrub during the long drought, when many of the water holes in the Park dry up and the quality and quantity of the available herbage become low. Thus it is chiefly during such times, that the cervids seem to have a heavy impact on the scrub.

Although a considerable body of information on the causes and consequences of bark damage by the Red deer *(Cervus elaphus)* is available in Europe (see Ueckermann 1960, Rijcken 1965, Ziegler 1967, Stubbe 1970 & Reijnders & Veen 1974) yet comparable data for the cervids in south-east Asia in general and in particular for those of Sri Lanka are lacking. Hence it was thought that a preliminary study in a National Park of the occurrence, causes and consequences of bark damage by cervids would provide data for comparison with already published information elsewhere. Furthermore, such information would become relevant in the management of the National Parks in Sri Lanka.

Vegetation

For the exact description of the study area and the climate of this particular region see previous work by Balasubramaniam et al. (1980) and that of Santiapillai & Chambers (1980). The predominant and characteristic vegetation in the Park could be categorized as thorn-scrub. Mueller-Dombois (1968) classifies the cover types in the Park into three broad categories: forest, scrub and herbaceous vegetation. He separates forest from scrub on the basis of height and considers a woody vegetation as forest when more than 20% of its crown biomass exceeds 5 m in height, while scrub represents all woody vegetation with its crown biomass below 5 m. If woody plants are sparse and cover less than 50% of an area of at least 2 ha, then the vegetation is defined as being herbaceous.

The forests are the climax community types of the region. The area was extensively cultivated during the reign of the Ruhuna dynasty and the present scrub and herbaceous vegetation are believed to be arrested stages in the secondary succession from cleared agricultural land to the climax community (Gaussen et al. 1968).

The common tree species found in the high stature riverine or gallery forests of the drainage areas of the Menik ganga within the Park are *Terminalia arjuna, Polyalthia longifolia, Madhuca longifolia, Berrya cordifolia* and *Nauclea orientalis.* Although *Aglaia roxburghiana* and *Garcinia spicata* are not typical riverine species, they were rather common in the gallery forest sampled by us at Talgasmankada and Kosgasmankada (Fig. 1).

The most characteristic vegetation cover of the Ruhuna National Park is an extensive forest scrub community. The dominant tree species of this community are emergent *Manilkara hexandra* and somewhat low-statured *Drypetes sepiaria.* Other associated trees are *Acacia leucophloea, Lepisanthes tetraphylla, Crateva religiosa* and *Sapium insigne.*

The filler species of this forest scrub are mainly thorny shrubs such as *Randia dumetorum, Flueggea leucopyrus, Carissa spinarum, Dichrostachys cinerea, Azima tetracantha* and several species of *Capparis*. In addition, *Cassia auriculata, Memecylon umbellatum* and *Phyllanthus pinnata* represent some of the common thorn-less shrubs. The herb layer of the forest scrub and the ground vegetation of the disturbed sites within the Park

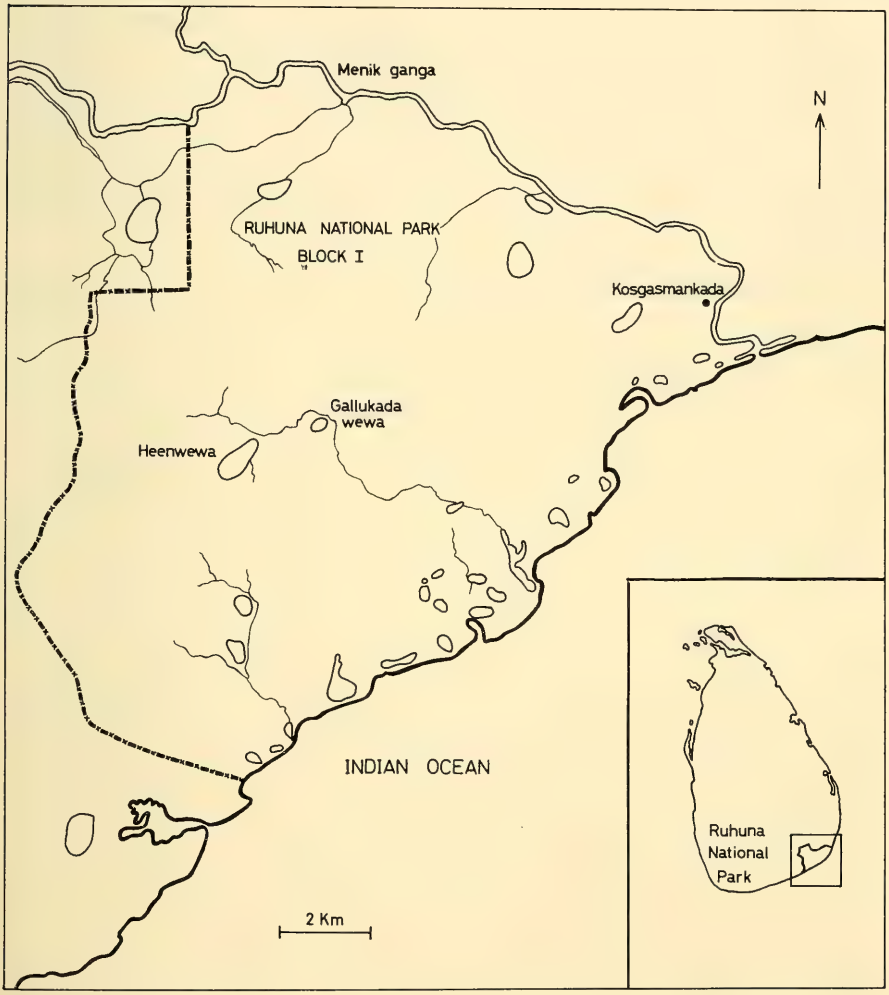

Fig. 1: Map of Ruhuna National Park (Block I) showing the study sites.

are characterized by ephemerals such as *Hibiscus micranthus, Sida acuta, Leonotis nepetifolia, Martynia annua, Thephrosia purpurea, Cassia occidentalis* and *Cassia tora*. The forest community also supports a large number of scandent shrubs or lianas. *Hugonia mystax, Jasminum angustifolium, Scutia myrtina, Ventilago maderaspatana* are some of the common woody vines found in the forest scrub. The forest scrub cover described above

occurs mainly in areas where the soil is well drained. The woody vegetation cover of the poorly drained grumusols are however characterized by stands of *Salvadora persica* and *Feronia limonia*.

The herbaceous vegetation cover of the wide open plains of the Park are composed of a large number of grasses and forbs. The common species encountered are *Alloteropsis cimicina, Chloris barbata, Cynodon dactylon, Dactyloptenium aegyptium, Eragrostris* spp., *Desmodium triflorum* and *Zornia diphylla*. In the wet areas the herbaceous vegetation cover is composed mainly of *Eriocaulon quinquangulare, Murdama spirata, Lindernia* spp., and several small sedges. In the vicinity of the lagoons, and especially in fine sandy soil a short pasture like plant community is found between the forest scrub and the shores of the lagoon. The herbaceous cover of this community is composed mainly of *Cynodon dactylon, Cyperus arenarius, Gisekia pharnacoides* and *Glinus oppositifolius*. During the wet season, the sedge *Bulbostylis barbata* is a conspicuous component of this community but it disappears during the drought.

In addition to the riverine, scrub forest and the various herbaceous vegetation cover types outlined above, there occurs within the Park, isolated patches of mangroves and a well developed community of maritime plants on the extensive sand dunes found along the south and south-eastern border of the Park. The dominant strand plants of the low fore dunes are *Spinifex littoreus, Remieria maritima* and *Hydrophyllax maritima*. Other common associates of this maritime community are *Launea sarmentosa, Emilia sonchifolia* and *Crotalaria retusa*. On stabilised high dunes situated further inland, are found woody species like *Pleurostylia opposita, Elaeodendron glaucum, Aglaia roxburghiana* and *Azadirachta indica*. On the landward side, this dune vegetation gradually merges with the forest scrub cover characteristic of the Park.

Methods

The study of the incidence and extent of bark damage by cervids was carried out in the Ruhuna National Park (Block I) through an examination of all the major tree species along linetransects in 1978, 1979 and 1980 during the long period of drought during the months June, July and August. A total of six linetransects, each of 250 m long, were surveyed at Heenwewa (scrub), Gallukada wewa (scrub) and Kosgasmankada (riverine forest). The study was confined to these localities (Fig. 1) as Park regulations do not permit dismounting at other stations within the Park. Along each of these line-transects, the species of the tree with damaged bark was identified, the nature of such damage by cervids was categorized (as to whether it was due to bark peeling or antler rubbing by cervids), and the extent or degree of damage was ranked as to whether it was low (less than 10% of the trunk damaged), medium (between 10 and 50% of the trunk damaged) and high (over 50% damaged). At each observation, the girth of the trunk with bark damage was measured, and the maximum height of the damage was also recorded.

Results and Discussion

The list of the species, their habitat, girth and the maximum height of damage, caused by cervids, and the nature and extent of such damage are indicated in Table 1.

A total of 153 species of woody plants have been recorded from Ruhuna National Park (Wirawan 1969). Of these, 28 species (18%) were observed to have sustained bark damage from cervids. Of these, 25 species (93%) were found in the scrub habitat, while 3 species (7%) were in the riverine forest habitat. Doubtless, more extensive surveys would yield more species being damaged by cervids. One reason for this high incidence of bark damage in the scrub as against the riverine forest could perhaps be due to the fact that cervids in general, and the spotted deer in particular, spend a large part of their diel cycle within the scrub during the long drought from June to September. This is especially so in scrub habitats around large permanent water holes such as Heenwewa, where more than 1000 spotted deer were counted within a day in the dry season (Wignarajah et al., 1978). Furthermore, in the scrub habitats there are several other alternative browse plants which could form a major portion of the cervid diet in the dry season, when the quality as well as the quantity of the available grass forage is low. Such a seasonal shift in the feeding, was observed in the case of the spotted deer (Balasubramaniam et al., 1980). Even during the wet season, with slightly lower ambient temperatures, the cervids retreat into the scrub habitats between 1000 and 1600 m. Such over-utilization of the scrub habitats by the cervids would result in proportionately more damage being caused by them in scrub as against riverine forests. Besides, the riverine forest is mainly composed of large, tall trees whose bark is either too fibrous to be peeled off or too smooth to rub against by the stags. Such riverine forests have a very sparse undergrowth and hence, the cervids do not spend much time within such habitats.

According to Ueckermann (1960) and Pellew (1968), the chief limiting factor for bark damage by cervids seems to be the girth of the trunk, then the thickness, hardness and smoothness of the bark. In the Ruhuna National Park, the girths of damaged trunks ranged from as low as 2 cm to as high as 43 cm. At the larger sizes however, there was only slight damage. The greatest bark damage was seen on trees with an average girth of 11.6 cm. The bark damage was found to be medium in trees whose trunk girth was about 7 cm or less while the damage was low when the girth was about 14 cm or more. Such a range is well within that observed by McIntyre (1975) for bark damage by deer in conifer plantations in Scotland, where the deer were found to select for trees with girth between 5 and 15 cm.

The maximum height from which the bark is damaged varied from as low as 10 cm to as high as 130 cm (Table 1.). According to Ueckermann (1960) and Rijcken (1965), most bark damage is from 75 cm to 125 cm although it could be from as low as 30 cm and as high as 170 cm. The average values for the girth and height of bark damage by cervids in the Ruhuna National Park on the basis of the 28 species of trees with bark damage is 10.7 cm and 83.1 cm respectively.

From Table 1, it appears that marked variations are seen in the relative susceptibilities of the various tree species to bark damage by cervids. The highest damage was caused by cervids to these trees through bark peeling rather than by antler rubbing. Bark is very vulnerable to peeling by cervids in the wet season or at the beginning of the dry season when with the availability of adequate water, new growth is vigorous and the bark in such plants could easily be peeled off. Furthermore, the bark at such times contains chemicals and essential nutrients which are selected by cervids. In the dry season, the bark becomes rather hard and the cervids resort to gnawing with their incisor teeth. The most heavily damaged species was *Cassia auriculata*. Almost every tree of this species was found to

have sustained bark damage. On the other hand, the least damage was seen on the bark of *Drypetes sepiaria*, which is ohne of the common species in the scrub throughout the Park.

Species	Family	Habitat	Girth (cm)	Height (cm)	Bark damage	
Aglaia roxburghiana	Meliaceae	F	43.0	128	BP	LOW
Atalantia monophylla	Rutaceae	S	26.5	130	BP/AR	HIGH
Berrya cordifolia	Tiliaceae	F	10.0	89	BP	LOW
Canthium coramandelicum	Rubiaceae	S	10.0	50	BP	LOW
Capparis zeylanica	Capparidaceae	S	9.5	112	BP/AR	LOW
Carissa spinarum	Apocynaceae	S	14.0	119	BP	HIGH
Carmona microphylla	Boraginaceae	S	2.0	50	BP	MEDIUM
Cassia auriculata	Leguminosae	S	8.0	117	AR	HIGH
Coffea wightiana	Rubiaceae	S	2.0	90	BP	MEDIUM
Diospyros ferrea	Ebenaceae	S	4.0	85	BP/AR	MEDIUM
Drypetes sepiaria	Euphorbiaceae	S	40.0	80	BP	LOW
Erythroxylum monogynum	Erythroxylaceae	S	12.0	123	BP	HIGH
Feronia limonia	Rutaceae	S	18.5	99	BP	MEDIUM
Flueggea leucopyrus	Euphorbiaceae	S	5.0	10	AR	MEDIUM
Flueggea virosa	Euphorbiaceae	S	2.0	60	BP	LOW
Garcinia spicata	Clusiaceae	F	10.0	120	BP	LOW
Gmelina asiatica	Verbenaceae	S	4.0	78	BP	MEDIUM
Hugonia mystax	Linaceae	S	10.0	85	BP	HIGH
Ixora arborea	Rubiaceae	S	9.5	76	BP/AR	MEDIUM
Jasminum angustifolium	Oleaceae	S	3.0	45	BP	HIGH
Lantana camara	Verbenaceae	S	4.0	25	BP	LOW
Memecylon umbellatum	Melastomataceae	S	18.0	75	BP	MEDIUM
Ochna squarrosa	Ochnaceae	S	5.0	90	BP	MEDIUM
Opilia amentosa	Opiliaceae	S	6.5	84	AR	HIGH
Pleurostylia opposita	Celastraceae	S	4.0	45	BP	LOW
Salacia sp.	Hippocrataceae	S	12.5	98	BP	HIGH
Sapindus emarginatus	Sapindaceae	S	4.0	85	BP	LOW
Scutia myrtina	Rhamnaceae	S	3.5	78	BP	HIGH

F = Forest; S = Scrub; BP = Bark Peeling; AR = Antler Rubbing;
LOW =less than 10% damage
MEDIUM =between 10 and 50% damage
HIGH =over 50% damage

Table 1: The average girth of the trees, the maximum height and summary of bark damage caused by cervids in the scrub and forest habitats of the Ruhuna National Park, Sri Lanka.

Many of the ungulates are known to eat bark at times. It is however, not known precisely why cervids feed upon the bark at certain trees. In the dry season, bark could be eaten to supplement the water intake as bark is known to be eaten as a source of water (König, 1970). The bark of many plants is also a rich source of energy and according to Wodsak & Ueckermann (1965), it contains vitamins, minerals, trace elements, roughage and tannins.

Besides bark peeling, trees are also damaged though to a much lesser extent, by stags rubbing their antlers against them. This is to peel off the decaying velvet skin on the antlers and such an activity reaches its peak in the Park just before the onset of the rut. In both spotted deer and sambar, the peak of rut takes place during the prolonged dry season (Santiapillai et al., 1980 and Santiapillai & Chambers, in prep.). The greatest number of stags in velvet was observed just prior to the long dry season in May.

The density of spotted deer in the Ruhuna National Park has been estimated at 23 per km^2 (Wignarajah et al., 1978) and that of sambar at 6.2 per km^2 (Kurt 1978). The bark stripping and antler rubbing activities of such large number of cervids would seem capable of exerting modifying effects on the woody vegetation of the Park. This could occur both through the removal of bark, hence retarding the growth, and the snapping of branches whilst stripping and rubbing. This latter effect may lead to extensive coppicing of the smaller trees and bushes. Much of the thorny scrub areas of the Park consists of highly coppiced woody vegetation.

It is likely that the combined effects of browsing by cervids and other herbivores, together with the bark stripping activities of the cervids, are responsible for maintaining much

of the Ruhuna National Park as dense scrub. Such activities may well be preventing the vegetation from returning to the tall-tree forest, which is the climax vegetation of this area.

Acknowledgements

We wish to thank Professors K. D. Arudpragasam and H. Crusz of the Universities of Colombo and Peradeniya respectively for their help and encouragement in our Ruhuna Studies. We also wish to thank Mr. Lyn de Alwis (Director, Department of Wildlife and Nature Conservation) and Mr. Childers Jayawardena (Assistant Director) for their help and hospitality during our visits. Our thanks to Mr. Tissa Alagoda for providing technical assistance. Finally, we are grateful to the National Science Council of Sri Lanka for financial support to carry out our work.

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Angenommen am 27. 2. 1981